

The alpine brown lacewing insect *Hemerobius schedli* (Neuroptera, Hemerobiidae) in Switzerland

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Abstract

The presence of the rare alpine insect *Hemerobius schedli* Hölzel, 1970 was confirmed with preserved museum specimens in Basel and London. In addition, live specimens were collected during light trapping in and around the Swiss National Park in the Engadin Valley in the summer of 2024 and by beating in the Visper Valley in 2025.

Key Words

Alps, Engadin, *Hemerobius nitidulus* group, *Pinus cembra*, Swiss National Park

Introduction

Currently there are four recognized species belonging to the so called “*Hemerobius nitidulus* group” within the brown lacewings of the Palearctic: *Hemerobius handschini* Tjeder, 1957, *Hemerobius nitidulus* Fabricius, 1777, *Hemerobius schedli* Hölzel, 1970, and *Hemerobius sucinus* Canard & Thierry, 2019 (Oswald 2025). These four species are all very similar, sharing uniformly coloured wings with dotted veins, but without spots. While *H. handschini* and *H. nitidulus* are rather common in Central Europe (Aspöck et al. 1980; Aspöck et al. 2001), *H. schedli* was first described from Austria in 1970 (Hölzel 1970) and is observed only very rarely, with a distribution range from the French Pyrenees to the Rila Mountains in Bulgaria and to the Baba Mountains in Macedonia in the south (Popov et al. 2018; Devetak et al. 2019, 2021). All three species live on conifers, mainly on pine species: *H. handschini* and *H. nitidulus* live mainly on a number of *Pinus* spp., whereas *H. schedli* is apparently restricted to *Pinus cembra* L. in the Alps (Popov et al. 2018) and *Pinus peuce* Griesb. in Eastern Europe (Popov 1986). They all feed on homopteran insects and other soft bodied arthropods, the first instars on eriophyid mites and insect

eggs (Stelzl 1991; Devetak and Klokočovník 2016). Information on the newly renamed *H. sucinus* (formerly *Hemerobius australis* Leraut, 1992) is scarce, with the species known only from a few specimens collected in France (Canard and Thierry 2019). Its status as a valid species distinct from *H. nitidulus* remains uncertain and needs further investigation (Oswald 2025).

In Switzerland, both *H. handschini* and *H. nitidulus* are widely distributed and commonly found in conifer forests. In contrast, *H. schedli* is a rare species, occurring only on certain mountain ranges across Europe, including the Alps, Pyrenees, Tatra Mountains, Rila Mountains, Prokletije Mountains, and Shar Mountains (Popov et al. 2018; Devetak et al. 2021). In the Alps, *H. schedli* has been reported in Carinthia, Tirol, and Styria regions of Austria (Hölzel 1970; Hölzel and Wieser 1999), the Alpes-Maritimes in France (Tillier 2015), Trentino-Alto Adige in Italy (Letardi 2022; Letardi and Badano 2025), and at Kuhgrat in Liechtenstein (Gepp 1986). For Switzerland, the only published records reported by Monserrat (1991) were three male and three female specimens collected in 1927 in “Upper Engadine” by M.E. Mosely and stored in the British Museum of Natural History (BMNH) in London. Until now *Hemerobius schedli* was not included in

the published Swiss Fauna of the Lacewing Digital Library (Duelli et al. 2025), as it was not listed in the Swiss National Database of Neuropterida (info fauna 2025). This database is still under development, and previously overlooked published records, such as that of Monserrat (1991), are occasionally being rediscovered.

In 2020, we started a comprehensive revision of all Neuropterida specimens housed in Swiss museums, with the aim of identifying any specimens that had not yet been classified and updating the names of previously identified specimens to reflect current taxonomy. Ultimately, the objective is to update the species distribution maps for Neuropterida in the Swiss National Database (info fauna 2025) and to enhance the species lists in the international Lacewing Digital Library (Duelli et al. 2025; Oswald 2025).

The uncertainty regarding the presence of *Hemerobius schedli* in Switzerland prompted us to thoroughly examine all specimens identified as *H. handschini* and *H. nitidulus*, as well as to visit the Neuroptera collection at the British Museum of Natural History (BMNH) in London to search for the Swiss specimens reported by Monserrat (1991). In Switzerland we conducted fieldwork from 2023 to 2025, particularly at sites with stands of *Pinus cembra* in and around the Swiss National Park in the Canton of Grisons and in the Visper Valley in the Canton of Valais. Our goal was to confirm a perennial presence of *H. schedli* in Switzerland.

Materials and methods

Since 2020, all Neuropterida (Neuroptera, Megaloptera, Raphidioptera) specimens deposited in Swiss museums were revised or identified and digitized. The material from the following museums was processed: Bündner Naturmuseum (BNM), Collection Agroscope Changings (AGRO), Entomologische Sammlung der ETH Zürich (ETHZ), Musée de la Nature Sion (MHNS), Musée d'Histoire Naturelle Fribourg (MHNF), Musée d'Histoire naturelle Neuchâtel (MHNN), Museo cantonale di storia naturale Lugano (MCSN), Muséum d'Histoire Naturelle Genève (MHNG), Muséum cantonal des sciences naturelles Lausanne (NATUREUM), Museum Luzern (MULU), Naturhistorisches Museum Basel (NMB), Naturhistorisches Museum Bern (NMBE), Naturmuseum Solothurn (NMSO) and Naturmuseum St. Gallen (NMSG).

Furthermore, the available literature was searched for evidence of the presence of *H. schedli* in Switzerland, leading to the additional analysis of material from the British Museum of Natural History in London (BMNH) thanks to the data reported in Monserrat (1991).

None of the visited Swiss museums had specimens labelled as *Hemerobius schedli*, but some males previously identified as *Hemerobius handschini* at the NMB could be identified as *H. schedli*. A large part of Swiss Neuropterida specimens at NMB were collected by Willy Eglin and colleagues during scientific studies in the Swiss National Park and surroundings between 1938 and 1978 (Eglin-Dederding

1980; Eglin-Dederding 1986). Specimens deposited at the BMNH in London were labelled individually as *H. nitidulus*, but rearranged under the name of *H. schedli*, presumably by Victor Monserrat (Monserrat 1991).

The discovery of *H. schedli* specimens at the NMB with rather precise locality labels led to the search for the species in 2023 and 2024. Brown lacewings were searched by means of beating and by light trapping in the Engadin region, Canton of Grisons (Fig. 1). In addition, the Visper Valley in the Canton of Valais was also visited in 2025. The collected insects were dry-prepared and for males, genital preparations were carried out using 10% KOH solution to soften the apex of the abdomen, which permitted to examine the internal structures that were prepared on a transparent plate embedded in Euparal.

Like the other species of the *H. nitidulus* group, *H. schedli* has brownish but spotless anterior wings with dotted veins, and like *H. handschini* has generally a dark frons. Given the high morphological variability of the group (Aspöck et al. 2001), the most reliable criterion for a clear distinction is the shape of the male genitalia, in particular the shape of the ectoproct (Hölzel 1970; Aspöck et al. 1980; Devetak et al. 2019; Devetak et al. 2021). However, it seems that a degree of uncertainty remains when using the external structures of male genitalia without an examination of the internal structures. It is therefore advisable to examine the gonarcus and entoprocessus in addition to the length of the katoprocessus (Aspöck et al. 2001; Canard and Thierry 2019). All genitalia of male specimens were prepared to be able to analyze the external as well as the internal structures.

Results

Male individuals were identified using examination of external and internal genital structures (Fig. 2). *H. schedli* specimens found are listed below.

Hemerobius schedli Hölzel, 1970

Specimens of the British Museum of Natural History (BMNH) in London examined:

SWITZERLAND • 1 ♂; Pontresina, Switz., G.C.C.; 5000–8000 ft; McLachlan Coll. - B.M. 1938-674.; det. Bärbel Koch; in Coll. BMNH, NHMUK015614138 • 4 ♂♂; Switzerland, Upper Engadine; 26.vi-11.viii.1927; leg. M.E. Mosely; [det. Victor Monserrat]; prep/rev. Bärbel Koch; in Coll. BMNH, NHMUK015614139 / NHMUK015614140 / NHMUK015614141 / NHMUK015614142.

The specimen from Pontresina was originally identified by R. McLachlan as *Hemerobius nitidulus*. Male specimens from the Upper Engadin region housed at the BMNH were identified by Victor Monserrat (Monserrat 1991; V. Monserrat, pers. comm.), although no identification labels were attached to them.



Figure 1. Sites of *Hemerobius schedli* males collected in 2024: **A.** Munt Baselgia and **B.** Alp Buffalora (Photos: Bärbel Koch).

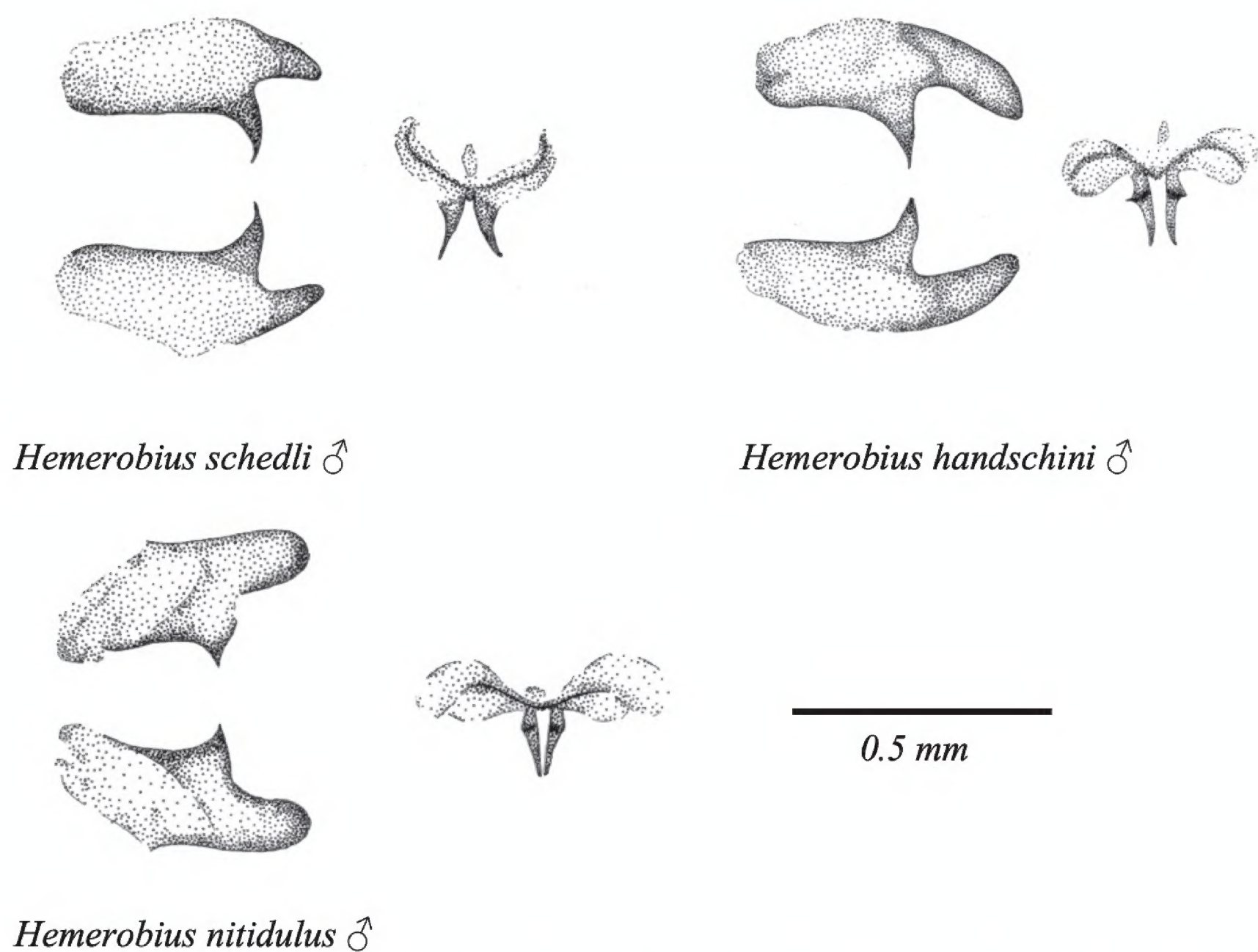


Figure 2. Drawings of prepared male genitalia with external and internal structures visible - on the left side ectoproct, on the right side gonarcus with entoprocessus: ♂ *Hemerobius schedli*; CH/GR, Trupchun, Schembrina; 28.07.1956 (top left); ♂ *Hemerobius handschini*; CH/GR, Val Müstair, Buffalora; 26.07.2024 (top right); ♂ *Hemerobius nitidulus*; CH/SZ, Gersau; 19.08.2023 (bottom left).

Specimens of the Naturhistorisches Museum Basel (NMB) examined:

SWITZERLAND • 1 ♂; Ofenpass, Buffalora, S.N.P.; 2100 m a.s.l.; Arve [*Pinus cembra*]; 30.06.1963; leg. W. Eglin; det. B. Koch; rev. P. Duelli; in Coll. NMB, NMB-IN-SEC0010225 • 3 ♂; Trupchun, Schembrina, S.N.P.; 2000 and 2100 m a.s.l.; Arve [*Pinus cembra*]; 28.07.1956; leg. W. Eglin; det. B. Koch; rev. P. Duelli; in Coll. NMB, NMB-INSEC0010226 / NMB-INSEC0010227 / NMB-IN-

SEC0010230 • 1 ♂; Fuorn, Alp Buffalora, S.N.P.; 2100 m a.s.l.; Arve [*Pinus cembra*]; 22.07.1956; leg. W. Eglin; det. B. Koch; rev. P. Duelli; in Coll. NMB, NMB-INSEC0010228 • 1 ♂; Ofenpass, Süsom Givè, S.N.P.; 2200 m a.s.l.; Arve [*Pinus cembra*]; 01.07.1963; leg. W. Eglin; det. B. Koch; rev. P. Duelli; in Coll. NMB, NMB-INSEC0010229 • 1 ♂; Fuorn, Buffalora, S.N.P.; 2000 m a.s.l.; Arve [*Pinus cembra*] (Pin., Larix); 19.07.1950; leg. W. Eglin; det. B. Koch; rev. P. Duelli; in Coll. NMB, NMB-INSEC0010231.

All specimens identified as *H. schedli* had been collected by Willy Eglin between 1950 and 1963, and identified as *H. handschini*, when *H. schedli* had not yet been described and Eglin did not recognize it as a different species.

Specimens collected in Engadin and Visper Valleys in 2024 and 2025:

SWITZERLAND • 1 ♂; CH, GR, Val Müstair, Buffalora; 816'810 / 169'450 [CH1903/LV03 = WGS84: 46°38'27.86"N, 10°16'15.47"E]; 1995 m a.s.l.; *Pinus cembra* and *Pinus mugo*; 26.07.2024; Light trap; leg. B. Koch, P. Duelli, T. Romanski; det. B. Koch; in Coll. BNM, GBIFCH01580200 • 1 ♂; CH, GR, Val Müstair, Buffalora; 816'810 / 169'450 [CH1903/LV03 = WGS84: 46°38'27.86"N, 10°16'15.47"E]; 1995 m a.s.l.; *Pinus cembra* and *Pinus mugo*; 26.07.2024; Light trap; leg. B. Koch, P. Duelli, T. Romanski; det. B. Koch; in Coll. B. Koch • 1 ♂; CH, GR, Zerne, Munt Baselgia; 804'455 / 176'880 [CH1903/LV03 = WGS84: 46°42'42.37"N, 10°06'46.80"E]; 2215 m a.s.l.; *Pinus cembra* and *Pinus mugo*; 27.07.2024; Light trap; leg. B. Koch, P. Duelli, T. Romanski; det. B. Koch; in Coll. MCSN, GBIFCH01389926, NEUR02448 • 1 ♂; CH, VS, Visperterminen, Giw; 637'310 / 122'890 [CH1903/LV03 = WGS84: 46°15'23.05"N, 7°55'20.98"E]; 1945 m a.s.l.; *Pinus cembra*; Beating; leg. B. Koch & P. Duelli; 23.07.2025; det. B. Koch; in Coll. B. Koch.

In 2024, at Buffalora two male *H. schedli* were collected together with one male of *H. handschini* by means of light trapping, whereas in 2023 only two male *H. handschini* were collected with beating. In contrast, at Munt Baselgia in 2024 only *H. schedli* was found (and three ♀ *H. cf. schedli*; Fig. 3) with light trapping. In 2024, all *H. schedli* were collected using light traps, whereas in 2025, one male was collected by beating *Pinus cembra*.

Discussion

The current presence of *Hemerobius schedli* is reported from various central and eastern European countries: France (Tillier 2015), Italy (Letardi 2022; Letardi and Badano 2025), Liechtenstein (Gepp 1986), Germany (Hiermann and Gruppe 2024), Austria (Gepp 2005; Hiermann and Gruppe 2024), Slovakia (Zelený 1977; Jedlička et al. 2004), Bulgaria (Popov 1986), Poland (Kaszyca-Taszkowska et al. 2022), Montenegro (Devetak et al. 2021) and North Macedonia (Devetak et al. 2021). In Switzerland, the occurrence of the species was considered uncertain until now, and it has therefore not been included in the country's current species list (Duelli et al. 2025). However, the species was already reported for Switzerland in various studies (Popov et al. 2018; Devetak et al. 2021), based on the report of Monserrat (1991), who cited specimens deposited at the BMNH.

Our revision of Neuropterida specimens held in Swiss museums and the examination of specimens from NMB and BMNH, combined with field research conducted from 2023 to 2025, permitted the confirmation of both the his-

torical and current presence of this species in Switzerland, specifically in the Canton of Grisons and in the Canton of Valais. The nearest occurrences are in Austria at Alpe Salomon in Voralberg Vandans about 45 km apart from the nearest Swiss population (Hiermann and Gruppe 2024), in Liechtenstein at Kuhgrat about 70 km apart (Gepp 1986), in Germany in Schachen südlich Garmisch-Partenkirchen about 110 km apart (Hiermann and Gruppe 2024) and in Trentino Alto-Adige (Letardi et al. 2010).

So far, all *H. schedli* specimens in the Alps and Tatra Mountains were found on *Pinus cembra* (e.g. Hölzel 1970; Kaszyca-Taszkowska et al. 2022; Hiermann and Gruppe 2024). All specimens we collected in Engadin during the summer of 2024 were caught using light traps in habitats dominated by *P. cembra* trees and with a significant presence of *Pinus mugo* subsp. *uncinata* (DC.), whereas the one male in Valais in 2025 was collected by beating *Pinus cembra*.

A likely explanation for the restriction of *H. schedli* to *Pinus cembra* is that *H. schedli* might be specialized on the aphid *Cinara cembrae*, a monophagous homopteran species on *P. cembra*. *Cinara cembrae* lives at altitudes of 1800–2100 m, just about the range where *H. schedli* is found. The other two species, *H. handschini* and *H. nitidulus*, also feed on other homopteran prey and therefore are not limited to the presence of particular conifers or to a particular altitude.

It is evident that the tree species on which *H. schedli* seems to depend is a postglacial relict with a fragmented distribution, currently threatened by climate change (Casalegno et al. 2010). In the future, populations of *Pinus cembra* may be forced to migrate to higher altitudes where suitable habitats will become increasingly scarce (Gugerli et al. 2022). These changes will also impact the presumed aphid prey, *Cinara cembrae*, and hence *H. schedli*, a species already considered rare and listed on various Red Lists (e.g. Gepp 2005; Gruppe 2020). In Switzerland, *Pinus cembra* remains widely distributed, with significant populations found in the Central Alps.

Our findings support the observation that *H. schedli* is typically found at altitudes between 1800 and 2200 m (Popov et al. 2018). The Munt Baselgia site, at 2215 m, is slightly above this range, though it does not approach the exceptional cases reported by Beron (1999) and Devetak et al. (2021), who observed the species at 2740 m on Marishki Chal in the Rila Mountains and at 3090 m in the Zillertal Alps, respectively. Since both localities are situated above the treeline, the finding of *H. schedli* at these altitudes is likely accidental, resulting from passive transport by the wind.

The close resemblance of *Hemerobius schedli* to the more common and widespread species *H. handschini* and *H. nitidulus*, combined with the difficulty in distinguishing these species using morphological criteria other than the male genitalia, has presumably led to *H. schedli* being largely overlooked both in collections and in the field. The frons colour, which is darker in *H. handschini* and *H. schedli*, but lighter in *H. nitidulus*, is not always reliable as a distinguishing feature. This is especially true when



Figure 3. ♀ *Hemerobius* cf. *schedli* collected at Munt Baselgia (27.07.2024). Unfortunately, no picture of live male *H. schedli* was taken (Photo: Peter Duelli).

assessing old or damaged specimens in collections, or even freshly collected individuals. Since both *H. schedli* and *H. handschini* exhibit a dark frons, the most reliable criterion for differentiation is the shape of the male genitalia. Although most studies and keys use the respective lengths of the ectoproct distal lobes (length of katoprocessus vs. length of anoprocessus) of male genitalia to distinguish *H. handschini* from *H. schedli* (Aspöck et al. 1980; Devetak et al. 2019), some authors suggest that this measure is not always reliable due to partial overlap, and it is therefore recommended to examine the internal male genital structures as well (Canard and Thierry 2019). To report reliable results, we thus examined the internal genital structures of every male specimen, given that in *H. schedli* the two arms of the gonarcus (entoprocessus) are clearly divergent, whereas in *H. handschini* and *H. nitidulus*, these arms are convergent (Fig. 2). We thus relied on a combination of criteria - dark frons, nearly equal lengths of the katoprocessus and anoprocessus, and divergent twin entoprocessus arms - to reliably distinguish males of *H. schedli* from the other two similar species. It is important to note that, in our case, we never observed the katoprocessus being significantly longer than the anoprocessus in any *H. schedli* specimen, as seen in *H. handschini*. Furthermore, we found the twin entoprocessus arms to be a much more reliable feature for distinguishing *H. schedli* from the other two species than the shape of the gonarcus as indicated in the identification key by Canard and Thierry (2019). Despite earlier descriptions by Hölzel (1970), female genital structures do not appear to be sufficiently reliable for species identification, as they are often lacking in the published identification keys (Aspöck et al. 1980; Canard and Thierry 2019). As

a result, females of *H. schedli* and *H. handschini* remain mostly indistinguishable, as do those of *H. nitidulus* with a frons that is not clearly pale. In the absence of reliable criteria to differentiate females, identification can only be inferred if no males from other species of the *H. nitidulus* group are present in the area (e.g. Devetak et al. 2021) or if a genetic analysis is conducted (e.g. Kaszyca-Taszakowska et al. 2022). The same arguments that apply to distinguish *H. schedli* from *H. nitidulus* also extend to the largely unknown species *H. sucinus*, which, within the *H. nitidulus* group, appears to share more similarities with *H. nitidulus*.

The difficulties in clearly distinguishing *H. schedli*, *H. handschini*, and *H. nitidulus* from a morphological standpoint have long been met with scepticism regarding their status as valid species. In fact, Aspöck et al. (2001) expressed uncertainty about the presence of three distinct species, suggesting that these three taxa might in fact represent different morphs of the same species. However, despite the strong morphological similarity between the three species and their likely recent divergence, Kaszyca-Taszakowska et al. (2022) reported a clear genetic distinction between *H. schedli* and the other two species, *H. handschini* and *H. nitidulus*, which proved more difficult to separate genetically. Previously, Morinière et al. (2014) also failed to find a genetic distinction between *H. handschini* and *H. nitidulus*, while *H. schedli* was not included in their analysis.

In conclusion, *H. schedli* is a rare species currently found in Switzerland, in habitats dominated by *P. cembra*, and further research is needed to better understand its distribution. Identification of individuals belonging to the *H. nitidulus* group collected in stands of *Pinus cembra* should be conducted with care to avoid overlooking *H. schedli*.

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